

FINAL REPORT

NASA GRANT NAG 5-2679

Hot Interstellar Matter in the Magellanic Clouds

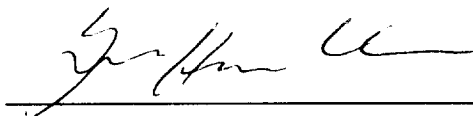
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Grant Technical Officer:
Dr. Donald West, Code 684.1
Lab for Astronomy and Solar Physics
NASA/Goddard Space Flight Center
Greenbelt, MD 20771

Grants Officer:
Gloria R. Blanchard
NASA/GSFC, Code 286.1
Greenbelt, MD 20771

NASA Scientific and Technical Information Facility
Accessioning Dept.
800 Elkridge Landing
Linthicum Heights, MD 21090

PI of Grant: You-Hua Chu
Department of Astronomy
University of Illinois

 June 9, '96

(Date)

FINAL REPORT FOR THE 1993 ADP GRANT: NASA NAG 5-2679

Title: Hot Interstellar Matter in the Magellanic Clouds

PI: You-Hua Chu, University of Illinois

Co-I: John R. Dickel, University of Illinois

Co-I: Mordecai-Mark Mac Low, University of Illinois

1. Program Description

We proposed to examine all archival ROSAT PSPC observations of fields in the Magellanic Clouds to search for diffuse X-ray sources. We would analyze the X-ray data and use them in combination with additional information from optical, UV, and radio observations to determine the physical nature of observed diffuse X-ray emission. The objects we expected to encounter included supernova remnants in unconventional interstellar environments, superbubbles, and kpc-sized supergiant shells. The scientific goals of this study were to better understand the state and evolution of the interstellar medium, especially how supernova and stellar winds injected energy into their surroundings.

2. Progress Report

During the grant period we carried out the tasks described in the original ADP proposal. We used the ROSAT PSPC mosaics of the Large Magellanic Cloud to study the large-scale diffuse X-ray emission and used individual PSPC pointed observations to study diffuse X-ray sources that are 20' or smaller (≤ 300 pc across).

Using archival ROSAT data, we diagnosed three new SNRs candidates, and confirmed their SNR nature with follow-up optical and radio observations. These three SNRs have been reported in two separate papers (Smith et al. 1994; Chu, Dickel et al. 1995). We have also analyzed archival ROSAT PSPC data of four X-ray-dim superbubbles, and found that the upper limit on their X-ray luminosity are consistent with those expected in pressure-driven bubble models. The results have been reported in an ApJ paper (Chu, Chang et al. 1995).

Using Snowden & Petre's PSPC mosaics of the LMC, we have examined diffuse X-ray emission from supergiant shells. Preliminary results have been presented in the Röntgenstrahlung from the Universe conference at Würzburg (Bomans et al. 1995). The supergiant shell LMC2 has by far the highest X-ray surface brightness. We have a series of follow-up optical observations to analyze the massive star content and dynamics of the

10^4 K ionized gas in LMC2. The analysis has developed into a PhD thesis project being undertaken by Sean Points.

The general results of this ADP program have been given in invited talks in the 1995 Mex-Tex meeting (10^4 - 10^6 K Ionized Gas in the Large Magellanic Cloud), the ROSAT conference Röntgenstrahlung from the Universe (ROSAT View of the ISM in the Large Magellanic Cloud), and the 1996 HEAD meeting (Hot ISM in the Large Magellanic Cloud).

Chu and Wakker have been awarded a NASA LTSA grant to expand the 1993 ADP program to investigate the structuring of the ISM by massive stars in the Magellanic Clouds.

3. Publications from the Grant Period

Two New SNRs in OB Associations in the Large Magellanic Cloud

1994, AJ, 108, 1266

Smith, R.C., Chu, Y.-H., Mac Low, M.-M., Oey, M.S., Klein, U.

Ultraviolet Interstellar Absorption Lines in the LMC: Searching for Hidden SNRs

1994, AJ, 108, 1696

Chu, Y.-H., Wakker, B., Mac Low, M.-M., García-Segura, G.

X-Ray Emission from Giant HII Regions in M101

1995, ApJ, 439, 132-144.

Williams, R.M. & Chu, Y.-H.

The Honeycomb Supernova Remnant

1995, AJ, 109, 1729-1734.

Chu, Y.-H., Dickel, J.R., Staveley-Smith, L., Osterberg, J., & Smith, R.C.

Negative Search for a Counterpart to the γ -Ray Repeater Source 0525-66

1995, ApJ, 448, 623-627.

Dickel, J.R., Chu, Y.-H., Gelino, C., Beyer, R., et al.

Diffuse X-ray Emission from the H-Deficient PN Abell 30

1995, ApJ, 448, L127-130.

Chu, Y.-H. & Ho, C.-H.

X-Rays from Superbubbles in the LMC. III. X-ray Dim Superbubbles

1995, ApJ, 450, 157-162.

Chu, Y.-H., Chang, H.-W., Su, Y.-L., & Mac Low, M.-M.

10⁴-10⁶ K Ionized Gas in the Large Magellanic Cloud

1995, Rev. Mex. A&A, 3, 153-160.

Chu, Y.-H.

Unsolved Problems and the Future of ISM Research: Interaction between Massive Stars and the ISM

1995, Rev. Mex. A&A, 3, 283-286.

Chu, Y.-H. & Mac Low, M.-M.

ROSAT View of the ISM in the Large Magellanic Cloud

1995, in the Röntgenstrahlung from the Universe, p. 311

Chu, Y.-H.

X-ray Emission from Superbubbles

1995, in the Röntgenstrahlung from the Universe, p. 241

Chu, Y.-H. & Mac Low, M.-M.

X-Ray Emission from Supergiant Shells in the LMC

1995, in the Röntgenstrahlung from the Universe, p. 237

Bomans, D.J., Chu, Y.-H., Magnier, E., & Points, S.